The larval host plant of *Polyommatus eroides* (Frivaldszky, 1835) (Lycaenidae) from Poland with comments on the life history

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Abstract. *Polyommatus eroides* (Frivaldszky, 1835) (Lycaenidae) is an endangered species of little known life history. It is distributed mainly in south-eastern Europe and reaches west Siberia. *Oxytropis* sp. and *Astragalus* sp. (van Swaay & Warren 1999) and *Genista depressa* (Tolman 1997) were mentioned as larval hostplants. Tolman (1997) recorded little data on the life history (including the way larvae feed and larval attendance by *Tapinoma* sp. ants). *Chamaecytisus ruthenicus* (Fabaceae) is shown here to be a larval hostplant of *P. eroides* in young pine woods to the east of the Puszcza Knyszyńska Forest in north-eastern Poland. The life cycle was observed in the laboratory from a fertilised female captured at the locality of Narejki (UTM: FD98) and five adults reared. In the summer L1, L2 and L3 larvae fed on leaves, leaving round almost transparent traces on the cuticles. Third instar larvae hibernated. In the spring larvae fed on buds, developing leaves, flower buds, and then flowers. *C. ruthenicus* was also confirmed to be a larval hostplant in nature – eggs, early instar larvae and traces of feeding on leaves were found at the locality of Grzybowce (UTM: FD88). Interactions of larvae with ants were not recorded, but *Formica cinerea*, *Myrmica ruginodis* and *Tetramorium caespitum* were identified on flowering plants.

Key words. Lycaenidae, *Polyommatus eroides*, larval hostplant, *Chamaecytisus ruthenicus*, life history, Poland.

Introduction

The False Eros Blue (*Polyommatus eroides* Frivaldszky, 1835) (Lycaenidae) is a species of little known life history. Additionally, it is critically endangered in Europe, where the distribution has decreased by 50–80% between 1970–1995, and its populations are often small, fragmented and isolated (van Swaay & Warren 1999). In Poland it has been classified as endangered (Buszko & Nowacki 2002) and has been protected since 2001. It is distributed mainly in south-eastern Europe (Bulgaria, Greece, Albania, Republic of Macedonia, Yugoslavia), but also in Poland, Slovakia, Ukraine, Belarus, Russia, and Turkey, while in the east it reaches west Siberia (van Swaay & Warren 1999). It was observed at one locality in the Czech Republic – in the years 1950–1957 where later on it became extinct (Beneš et al. 2002). According to the region of occurrence, it inhabits dry calcareous and siliceous grasslands and steppes, alpine and subalpine grasslands, rocky or sandy places, edges of forests, young pine woodlands, wet forest meadows and small open places in forests with fresh soil between 1000 and 2000 m (van Swaay & Warren 1999; van Swaay pers. comm.). In most countries, there is no larval hostplant recorded. Van Swaay & Warren (1999) mentioned *Oxytropis* sp. and *Astragalus* sp. (Fabaceae) as *P. eroides* larval foodplants. This information was recorded from dry calcareous grasslands and steppes and dry siliceous grassland in Slovakia (van Swaay pers. comm.). Tolman (1997) mentioned another hostplant – *Genista depressa*. Moreover, he stated that eggs are laid on leaves, small larvae feed on leaves, hibernating larvae feed on flowers, and caterpillars are attended by *Tapinoma* sp. ants (Formicidae).

Figs. 1–8. Stages of development of *P. eroides*. **1.** The eggs (photo by J. Chobotow). **2.** 2nd instar larva feeding on leaves in August. **3.** 3rd instar larva feeding on buds in April. **4.** 4th instar larva feeding on flowers in May. **5.** The final instar larva on flowers in May. **6.** Four-days old pupa. **7.** Pupa before a male emergence. **8.** The male.

Figs. 9–10. The habitats of *P. eroides*. **9.** The locality of Narejki. **10.** The locality of Grzybowce.

Polyommatus eroides eroides (Frivaldszky, 1835) is the subspecies that occurs in Poland (Carbonell 1994). According to older data, it was very rare at several localities in the northern, central, and southern parts of the country (Romaniszyn 1929). In the Puszcza Białowieska Forest it was common in its eastern part (nowadays in Belarus) and rarer towards the west (Krzywicki 1967). Glades and edges of dry pine and coniferous forests were identified as a typical habitat for *P. eroides* (Krzywicki 1967). According to more recent data, *P. eroides* is found in Podlasie in north-eastern Poland (Buszko 2000; Buszko 1997; Klimczuk & Twerd 2000). It was also recorded in the southern part of the Puszcza Białowieska Forest and in areas to the south-east of it, towards the river Bug (Buszko 1997). Larval hostplants were not known. In 1998 *P. eroides* was found

Figs. 11–12. The larval hostplant of *P. eroides*. **11.** *Chamaecytisus ruthenicus* at the locality of Grzybowce in August. **12.** *Chamaecytisus ruthenicus* at the locality of Grzybowce in May.

north of the Puszcza Białowieska Forest, in the eastern part of the Puszcza Knyszyńska Forest (Klimczuk & Twerd 2000). Further observations carried out in this area resulted in obtaining more information on the life history of that species.

Material and methods

The study was divided into two parts. The first was initiated during routine observations of butterflies near the village of Narejki (UTM: FD98), to the east of the Puszcza Knyszyńska Forest. In the clearing of a dry pine forest I observed a flying male and a female of *P. eroides* (17.vii.1999) (Fig. 9). The female, when captured and placed in a small dark box, laid 10 eggs on the leaves of *Chamaecytisus ruthenicus*. This plant was selected based on an analysis of the floristic composition of the clearing and on a short observation of the female before it was captured. The caterpillars were reared on cut stems of the plant. The container with the larvae was exposed to natural temperatures (in winter the temperature decreased below 0 °C). The larvae survived the hibernation period on fallen leaves of the plant, kept in a container with humid soil. From the upper side and the soil side the hibernated larvae were covered with lignin for protection. Due to the small quantity of available material the rearing was focused on obtaining adults. The second part of the project involved field observations with the purpose of confirming the conclusions drawn from the laboratory results. The observations were carried out near the village of Grzybowce (UTM: FD88) in a long and narrow clearing in a dry, young pine forest (Fig. 10). *P. eroides* was first reported there in 1998 (Klimczuk & Twerd 2000); two males were found there as well on 03.vii.1999 (author's observation). The dwarf shrubs of *C. ruthenicus* (Figs. 11, 12) growing along a 2 km stretch were examined. Ova and larvae were collected in the field and reared in the same way as during the first stage of the research. Ants (5–10 workers of each species) were collected from flowering plants for identification.
Photographs of the localities, larval foodplant, and developmental stages of *P. eroides* were made.

Results

First part of the study. The life cycle of *Polyommatus eroides* was observed in the laboratory from the moment of oviposition by the captured female till the emergence of the imagines. From ten eggs five adults (3♂ and 2♀) were reared. The chronology of the rearing is presented in Table 1. In the summer, younger larvae (L1, L2 and L3) fed on upper and lower sides of leaves, leaving circular and almost transparent traces on the cuticle, but did not gnaw right through the leaves (Fig. 2). The third instar larvae (and one fourth instar larva) hibernated. The additional summer moult observed for one caterpillar was probably caused by an injury to this larva during its transfer to a fresh part of the plant. After an hibernation period lasting over seven months (from the first decade of September to the first half of April), two moults took place. In the early spring (April), after regaining activity, larvae fed on buds (Fig. 3), then on developing

Tab. 1. Rearing data – chronology. These events are presented only for trials resulting in the emergence of the adults.

Developmental stage	**Rearing initiated from a female captured (first part of research)**	**Rearing initiated from an ovum found in the field (second part of research)**
	oviposition: 17.vii.1999	ovum found: 13.viii.2000
ovum stage	17.–24.vii.1999 (7 days)	?–14.viii.2000
larva stage	24.vii.1999–16./19.v.2000 (> 9.5 months)	14.viii.2000–28.v.2001 (9.5 months)
first instar	24.vii.–30./31.vii.1999 (6–7 days)	14.–21.viii.2000 (7 days)
second instar second instar (only one larva) third instar (only one larva)	30.–31.vii.–24./29.viii.1999 (25–29 days) 31.vii.–18.viii.1999 (18 days) 18.viii.–03.ix.1999 (16 days)	21.viii.–03.ix.2000 (13 days)
third instar fourth instar (only one larva)	24./29.viii.1999 – 20./22.iv.2000 (ca. 8 months) 03.ix.1999–21.iv.2000 (ca. 8 months)	03.ix.2000–30.iv.2001 (8 months)
feeding stop	between 05.–10.ix.1999	15. or 16.ix.2000
diapause	7 months	7 months
regaining activity	14.–17.iv.2000	between 15.–18.iv.2001
fourth instar fifth instar (only one larva)	20.–22.iv. – 28./29.iv.2000 (7–8 days) 21.iv.–30.iv.2000 (9 days)	30.iv.2001–07.v.2001 (7 days)
final instar (incl. prepupal phase) final instar (only one larva)	28.–29.iv. – 16./18.v.2000 (18–19 days) 30.iv.–19.v.2000 (19 days)	07.v.–28.v.2001 (21 days)
termination of feeding	9.v.–12.v.2000	19.v.2001
pupa stage 1 – male 2 – male 3 – male 4 – female 5 – female	16.v.–05.vi.2000 (20 days) 17.v.–07.vi.2000 (21 days) 18.v.–07.vi.2000 (20 days) 18.v.–11.vi.2000 (24 days) 19.v.–11.vi.2000 (23 days)	28.v.–22.vi.2001 (25 days)

leaves, flower buds, and finally, from the end of April till mid May, on flowers (Figs. 4, 5). During the flowering period of *C. ruthenicus* larvae were reluctant to feed on leaves, and they only did so when flowers were not supplied to them. The green and green-yellowish larvae with black head and single bright lateral stripes grew to a length of over 15 mm. After they stopped taking food they became slightly glittering, started to wander, and finally, prior to pupation, they tended to hide themselves under plant fragments on the box floor. They linked plant fragments with delicate threads and fixed themselves to them by a girdle. The larval stage lasted over 9.5 months altogether. The pupae, about 12 mm in length, were yellow-greenish and amber (Fig. 6). No pupa shed the larval cuticle from the last segments of the abdomen. The pupal stage lasted 3–3.5 weeks (Figs. 6, 7). Imagines emerged in the first half of June. Males were the first to emerge (Fig. 8). Attempts at inbreeding failed. Eggs (Fig. 1) laid by one female were not fertilised.

Second part of the study. Based on the observations gathered in the laboratory, immatures were searched for in the locality of Grzybowce (UTM: FD88). The following specimens and traces of *P. eroides* in the field were found:

- 10.vii.2000 – two eggs were found on leaves of *C. ruthenicus*.
- 13.viii.2000 – fragments of egg covers, one larva of several days old, and one egg on the upper side of a leaf of *C. ruthenicus* were found; circular feeding spots were found on leaves (similar to those observed in the lab rearings but fewer per leaf than documented on Fig. 2).
- 20.vii.2001 – two eggs were found on leaves of *C. ruthenicus*; a male was observed exactly at the same place as on 03.vii.1999; it was flying and nectaring on flowers of *Thymus serpyllum*.

From the egg found on 13.viii.2000 a male of *P. eroides* was reared (the chronology of the rearing events is presented on Tab. 1). Thus, the eggs found in the field were confirmed to have been correctly identified. The following facts were also noted. During the first and second moults (before hibernation), the larvae positioned themselves on the main vein, on the upper side of leaves. During the fourth moult (in May), one surviving larva was sitting on the lower side of a flower bud with the head pointed towards the stem. One egg found on 10.vii.2000 was parasitised but the parasitoid was not identified.
Thus, the above research identified *Chamaecytisus ruthenicus* (Fisch. ex Woł.) Klásk. (Fabaceae) as a larval hostplant of *Polyommatus eroides* in north-eastern Poland.
The locality of Narejki (UTM: FD98), where the female was captured to initiate the rearing, is a new locality for *P. eroides*. Both sexes of that species were flying in a dry pine forest clearing. In the vicinity, there are several 12-year-old pine trees, separated by barren and grassy spots. In that slightly hilly area *C. ruthenicus* grows at the edges and inside the forests, but also in the clearings. At the time of occurrence of *P. eroides* three individuals of *Colias myrmidone* (2♂ and 1♀) were also observed. The locality is situated at about 2 km from the Belarus border.
Three species of ants visiting *C. ruthenicus* flowering stems in May (collected on 27.v.2004 at the locality of Grzybowce) were identified. These are: *Formica* (*Serviformica*) *cinerea* Mayr, 1853 (Formicidae), *Myrmica ruginodis* Nylander, 1846 (Formicidae) and *Tetramorium caespitum* Linnaeus, 1758 (Formicidae).

Discussion

Despite specific searches in the field, no larvae feeding on flowers in the spring were found and no interactions of larvae with ants were recorded, although facultative myrmecophily is possible. The three species of ants mentioned above are reported to tend lycaenid larvae and facultative myrmecophily within the genus *Polyommatus* is well known (Fiedler & Bálint 1992; Fiedler 1995). Tolman (1997) mentioned that *Tapinoma* sp. ants attend *P. eroides* caterpillars.
Chamaecytisus ruthenicus is a larval hostplant for *P. eroides* populations living in dry, young pine forests. Although the observation concerns only Poland, it is highly probable that *C. ruthenicus* is also a larval foodplant in neighbouring Belarus where *P. eroides* occurs in a similar habitat –young pine plantations (van Swaay and Warren

1999). The flowering period of *C. ruthenicus* lasts from April through June. That plant reaches the north-west limit of its range in Poland. It is also distributed in Belarus, Ukraine, reaching Crimea, the Caucasus, and west Siberia (Kostrakiewicz 1959). As mentioned in the Introduction, *Oxytropis* sp., *Astragalus* sp. (van Swaay and Warren 1999), and *Genista depressa* (Tolman 1997) were reported as larval foodplants for *P. eroides*. *Genista depressa* does not occur in Poland; it occurs in Ukraine and Bulgaria (Kostrakiewicz 1959). The way larvae feed on that plant, as described by Tolman (1997), is similar to that which I observed on *C. ruthenicus*. Although *Oxytropis pilosa* and *Astragalus* sp. (several species) do exist in the Puszcza Knyszyńska Forest (Sokołowski 1995), I have not observed *P. eroides* on these species in this region so far. It is possible that for the population of *P. eroides* inhabiting regions to the south-west of the Puszcza Białowieska Forest (Buszko 1997) there may be another larval foodplant closely related to *C. ruthenicus*, such as *Chamaecytisus ratisbonensis* (Schaeff.) Rothm. (Fabaceae), for which the flowering time is also from April through June, and which similarly reaches in Poland the north-west limit of its range. Nevertheless, *C. ruthenicus* reaches the Puszcza Knyszyńska Forest and its eastern vicinity (Sokołowski 1995; Zając & Zając 2001) while *C. ratisbonensis* only the Puszcza Białowieska Forest (Zając & Zając 2001). Interestingly, I observed individuals of *P. eroides* at sites where *Colias myrmidone* also was present.

I hope that my work will result in efforts being undertaken to preserve this beautiful endangered lycaenid. There is obvious evidence that further research is needed but the very low density of this *P. eroides* population will make it a serious difficulty. I have seen several males and only one female in the field so far.

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